

Fact Sheet for Corrective Measures Study

SWMU 8 – Landfill IV

Description: SWMU 8, also known as former Landfill IV, is a 140-acre area that was the primary disposal site for wastes generated from the various operating areas of Chambers Works from approximately 1940 to 1975. These wastes included solid and semi-solid wastes (bulk sludge and tars, basin and river dredgings, spent carbon and catalyst, fly ash, drummed powders, and asbestos), empty containers, construction debris and building rubble, trash and general refuse, soil fill, and liquid wastes (waste oil, spent solvents, etc.) and discarded machinery and equipment. A majority of these wastes were disposed in bulk form, however some wastes were disposed of in drums (steel or cardboard), barrels, or other containers. Operation of Landfill IV was the responsibility of the Chambers Works S&T Department. The S&T Department used approximately 21 narrow gauge sludge cars and 175 waste hoppers to collect process waste from all operating areas of Chambers Works for transport to Landfill IV (DuPont, 1969). In addition, the S&T Department managed activities within the Landfill IV area (now designated as SWMU 8), including recycling of scrap metal and empty containers, incinerating liquid chemicals and solid waste, and disposing non-process general trash. As the SWMU 8 area was filled in over time, additional operating areas were constructed on top of the filled areas.

Landfills A and B were issued an NJDEP Certificate of Approved Registration (#1713B) on September 15, 1975. This landfill registration described the permitted material for disposal in Landfill A and B as follows: “the elastomeric waste, oils, tars, silt, iron, hydroxide, aluminum hydroxide and iron oxide sludges. No radioactive materials, septic tank wastes, sewage sludge, or liquid or soluble chemicals may be disposed at this site.” On March 8, 1983, the certificate of registration was modified to allow the disposal of rubble, asbestos, plastic, bottom ash, and fly ash. Landfills A and B (SWMU 30) were constructed on top of SWMU 8.

An evaluation of available historical records showed that approximately 178,000 containers were disposed of in Landfill IV between 1940 and 1975, and that drummed waste accounts for approximately 1% of the total fill volume within SWMU 8. Results of this evaluation including references to supporting documentation were submitted to NJDEP and EPA via electronic mail on February 9, 2004. DuPont has also reviewed available research on corrosion of buried drums to determine expected longevity of drums in SWMU 8 (Mutch and Sutherland, 1990; Mutch and Norris, 2001). Based on this research, site-specific conditions of SWMU 8, process knowledge of the historical drum disposal methods, and recent investigations, it is unlikely that any intact drums remain within SWMU 8.

Historically, the SWMU 8 area consisted of wetlands adjacent to Whopping John Creek prior to DuPont activities. Between 1900 and 1930, the SWMU 8 area was used for smokeless gunpowder storage associated with the Carneys Point Works. In 1940, the initial filling operations commenced along the western edge of the SWMU 8 area.

By 1956, the Landfill IV area expanded to replace a majority of the Whopping John Creek marsh along the western portion of the area. Surface-water drainage from Whopping John Creek was diverted into a ditch that traverses the area.

Under the current state, the surface cover includes asphalt, concrete, gravel, foundation, and vegetation. The majority of the 140 acres is currently not in use.

Extensive investigations as part of the SWMU 8 RI (CRG, 2005) show that the landfill units are stable and do not contain intact drums. The nature of the fill material in SWMU 8 (including the physical and chemical properties of the fill) and the detected constituents are consistent with past disposal practices. The current pump-and-treat system maintains hydraulic control of groundwater at the site and prevents off-site groundwater migration.

SWMU 8 contains, in whole or in part, several individual SWMUs. The SWMUs and their descriptions are listed below.

SWMU	Description
1	Incinerator I
2	Incinerator II
3	Incinerator III
4	Incinerator IV
7	Landfill III
17	Portions of the Process Water Ditch System
20	Ethyl Chloride Incinerator
21	Thermal decontamination incinerator (FR-65)
22	Multipurpose incinerator (FR-01)
23	Chemical waste tank area
24	Chemical waste container storage areas A and B
30	Landfills A and B
33	Manhattan Project Area
39-4 and 39-7	Underground Storage Tanks
55-2, 55-5, and 55-6	Fill Deposition Areas
56A	Portions of the Historical Process Water Ditch System

The location of SWMU 8 and the other associated SWMUs are shown in Figure A-1. In addition, photographs taken in June 2007 are provided.

Size of Unit: 140 acres

Period of Use: 1940 to 1975

Remedial Action: None.

An Interim CMS and RASR for SWMU 8 was submitted (CRG, 2007). For the Interim CMS and RASR, SWMU 8 was divided into six areas:

- Landfill A Area
- Landfill B Area
- Northern Basin Area
- Northwestern Fill Area
- Western Fill Area

- Southern Fill Area

These areas have similar historical origins that can be readily demarcated from surrounding areas by physical boundaries, waste content, chemical characteristics, or a combination of these factors. The areas were identified based upon the following three criteria:

- Mode of original placement and waste content based on aerial photograph review
- Exceedance of applicable screening criteria that suggest potential contribution of constituents from soil to groundwater
- Concentrations that would suggest the presence of NAPL

In addition, an additional forested area (11.3 acres) is located within the traditional boundary of SWMU 8. This area is not believed to be impacted because no manufacturing or waste management activities were conducted there.

The *SWMU 8 CMS-RASR* identified promising technologies to address significant sources that met the selection criteria (DuPont, 2007) for the Landfill A Area, the Northwestern Fill Area, and the Northern Basin Sub Area. Potential technologies were presented that could be implemented to mitigate groundwater impacts from source areas below the water table.

Characterization of the surface-water quality prior to entering and exiting SWMU 8 via concrete pipes under Landfill A was completed during six sampling rounds in 2006. No further sampling activities were recommended.

Two surface-water features (C and D Ponds) located within SWMU 8 were evaluated, and results were presented in the Ecological Investigation Report (URS, 2009). No further evaluations were recommended for these areas.

- A Treatability Study Work Plan was completed in 2009 to evaluate these remedial options. The Treatability Study RIR (URS, 2010) included sampling of groundwater and soil within the aquifer zones and confining units. This study concluded that characterization of the A/B and B/C discontinuities were complete; no additional stratigraphic investigations are necessary. Results of the biodegradation assessment indicated that anaerobic degradation is occurring in the B aquifer beneath SWMU 8. No DNAPL was identified in the Northern Basin-Sub Area, Landfill A, or the Southern Fill Area. Therefore, no additional investigations or remedial actions were required for these three areas. In the Northwestern Fill Areas, DNAPL is present at the northwestern boundary of SWMU 8 and occurs as a pool at the base of the B Aquifer. This DNAPL was fully delineated at its northern boundary. To identify and treat significant sources below the water table in the site interior, additional soil and groundwater sampling was completed to further characterize the pooled DNAPL and the associated source(s). In addition, pending the results of the surfactant study, a pilot test of surfactant-enhanced DNAPL recovery was recommended for the L13 boring area. The surfactant study was completed for the Northwestern Fill Area (L13) by Surbec Environmental in 2011.

- Subsequently, additional groundwater sampling at and to the northeast of SWMU 8 was completed as part of the interior investigation activities (URS, 2013) and the RFI Data Gap Sampling conducted in early 2014. In the Comprehensive RFI Report, the source prioritization tool, visual, soil saturation, and groundwater summed concentration-TAS ratios were evaluated in conjunction with each other to map probable and potential DNAPL source zones. Analysis of these results shows that the extent of DNAPL in the Northwestern Fill Area and to the north has been delineated as shown in Figure 7-28 of the Comprehensive RFI Report (URS, 2014) with no DNAPL source zones identified to the north of the Northwestern Fill Area.

Constituents: The evaluation of constituents within SWMU 8 that exceeded applicable criteria was based on the results of numerous investigations. Investigations pertaining to the SWMU areas within the SWMU 8 boundary were documented in previous RFI phases and referenced in their respective fact sheets.

Investigative information and/or results pertaining specifically to SWMU 8 are documented in the following reports:

- *SWMU 8 (Landfill IV) Remedial Investigation Report* (DuPont, 2005)
- *Preliminary Assessment Report* (CRG, 2006)
- *Revised Baseline Ecological Evaluation*, (CRG, 2006)
- *SWMU 8 (Landfill IV) Remedial Investigation Report 2005 Addendum* (CRG, 2006)
- *SWMU 8 (Landfill IV) Remedial Investigation Report – Surface Water Investigation 2007 Addendum*. (CRG, 2007)
- *SWMU 8 Interim Corrective Measures Study and Remedial Action Selection Report* (DuPont, April 2007)
- *SWMU 8 Treatability Study Work Plan* (URS, 2009)
- *Ecological Investigation Report* (URS, 2009)
- *Treatability Study Remedial Investigation Report* (URS, 2010)
- *Interior Investigation Technical Memorandum* (URS, 2013)
- *RCRA Facility Investigation Data Gap Sampling Plan* (URS, 2013)
- *Vapor Intrusion Remedial Investigation Work Plan* (URS, 2014) with data presented in the *Comprehensive RCRA Facility Investigation Report* (URS, 2014)
- *Site Investigation Report for PFOA* (CRG, 2006c), *Site Investigation Report Addendum for Perfluorooctanoic Acid* (CRG, 2007), and *Perfluorooctanoic Acid Groundwater Investigation Report Addendum II* (URS, 2011).

As part of the Comprehensive RFI Report (URS, 2014), constituents were evaluated at each location sampled within SWMU 8. For soil, NJNRDCSRS and NJIGWSRS were used for comparison. For groundwater, NJGWIIA were used for comparison. Detections

for PFOA in soil were compared to the EPA Region 4 (2009) residential soil screening value. Detections in groundwater for PFOA and PFOS were compared to the Provisional Health Advisories developed by EPA (EPA, 2009). Figures and tables from the Comprehensive RFI were used to produce the summary tables presented in this Fact Sheet. The soil figures from the Comprehensive RFI present the locations throughout the manufacturing area where constituents exceeded NJNRDCSRS. The groundwater figures that were used from the Comprehensive RFI display by analyte group (i.e., VOCs, SVOCs, etc.), aquifer, and the constituents that most frequently exceeded the screening criteria by the greatest margin of exceedance for all locations within the entire manufacturing area. There may be additional analytes that exceed the screening criteria at each location, but only the analyte with the greatest exceedance margin is shown on the figures at each location and listed in the tables below.

Soil samples were collected (see the table below) to characterize soil at SWMUs, to assess biodegradation potential or to confirm the presence of potential historical sources within the AOC. Soil data related to SWMUs where soil was removed or remediated were not included. The soil table below provides a summary of the information presented in Appendix C.1 of the Comprehensive RFI Report (URS, 2014). Soil data collected within the extent of SWMU 8 indicate exceedances of NJNRDCSRS for VOCs, SVOCs, metals and pesticides/total PCBs. There were no PFOA or PFOS exceedances. Constituents that exceeded the NJNRDCSRS within SWMU 8 include the following.

VOCs (76 locations)	SVOCs (71 locations)	Metals (73 locations)	Pesticides/ Total PCBs (27 locations)	PFOA/ PFOS (3 locations)
1,1,2-Trichloroethene 1,2-Dichlorobenzene 1,4-Dichlorobenzene Benzene Carbon Tetrachloride Chloroform Methylene Chloride Tetrachloroethene Trichloroethene Vinyl Chloride	1,2,4-Trichlorobenzene 1,2-Diphenylhydrazine 2,4-Dinitrotoluene 2,6-Dinitrotoluene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene Bis(2-ethylhexyl)phthalate Bis(2-ethylhexyl)phthalate Dibenz(a,h)anthracene Hexachlorobenzene Indeno(1,2,3-cd)pyrene Naphthalene Nitrobenzene	Arsenic Lead Mercury Thallium	Dieldrin Total PCBs	No exceedances /No detections

Soil exceedances within SWMU 8 are localized and within areas that have sufficient ground cover to prevent exposure. Soil investigation related to SWMUs has been completed.

Groundwater samples were collected at several locations (see the table below) from the B, C, D and E aquifers, respectively within the SWMU 8 boundary. Groundwater in SWMU 8 contains constituents above NJGWIIA with the B aquifer having the highest concentrations. In general, concentrations decrease with depth in the lower aquifers. The table below provides a summary of the information displayed in Figures 7-5 through 7-24 (excluding Figure 7-21) of the Comprehensive RFI Report (URS, 2014). Constituents that exceeded the screening criteria with the greatest margin of exceedance at each sampling location within AOC 1 include the constituents listed in the following table.

B Aquifer				
VOCs (67 locations)	SVOCs (63 locations)	Metals (68 locations)	Pesticides/ Total PCBs (44 locations)	PFOA/ PFOS (6 locations)
Benzene Chlorobenzene Trichloroethene Tetrachloroethene Vinyl Chloride 1,2-Dichloroethane Other	Aniline Hexachlorobenzene Nitrobenzene 1,2,4-Trichlorobenzene 2-Naphthylamine 2,4-Dinitrotoluene 4-Chloroaniline Other	Aluminum Antimony Lead Other	Aldrin Alpha-BHC Total PCBs 4,4'-DDD 4,4'-DDE Other	PFOA PFOS - Not Analyzed
C Aquifer				
VOCs (12 locations)	SVOCs (12 locations)	Metals (12 locations)	Pesticides/ Total PCBs (2 locations)	PFOA/ PFOS (3 locations)
Benzene Chlorobenzene	Aniline 2-Naphthylamine 4-Chloroaniline	Antimony Other	No Exceedances/No Detections	PFOA PFOS - No Exceedances/No Detections or Not Analyzed
D Aquifer				
VOCs (5 locations)	SVOCs (5 locations)	Metals (4 locations)	Pesticides/ Total PCBs (0 location)	PFOA/ PFOS (1 location)
Benzene	Aniline 1,2,4-Trichlorobenzene	Other	NA	PFOA PFOS – No Exceedances/No Detections
E Aquifer				
VOCs (1 location)	SVOCs (1 location)	Metals (1 location)	Pesticides/ Total PCBs (0 location)	PFOA/ PFOS (1 location)
No exceedance/detection	No Exceedances/No Detections	Other	NA	No Exceedances/No Detections

“Other” is defined in Figures 7-1 through 7-24 of the Comprehensive RFI Report (URS, 2014)

As part of the Comprehensive RFI Report assessment of soil and groundwater, a multiple lines-of-evidence approach was used to identify DNAPL source zones across the manufacturing area. Under SWMU 8, probable and potential DNAPL source zones were identified for the B aquifer. Analyses of two DNAPL samples collected at locations in the B aquifer within the Northwestern Fill Area of SWMU 8 indicate that the highest mass fraction of the samples consisted of nitroaromatics, chlorinated benzenes, and BTEX. Two relatively small probable and potential DNAPL source zones located in the Northwestern Fill Area of SWMU 8 were also identified in the C aquifer. Evaluation of the exceedances and probable and potential DNAPL source zones in the B aquifer indicate that B aquifer groundwater is impacted beneath the entire area of SWMU 8. DNAPL present in the northwestern corner of SWMU 8 is actively recovered in well L13-M01B. However, groundwater plumes are co-mingled, heterogeneous, and extend beyond the SWMU 8 boundaries. Potential releases (especially from waste ditches) were not limited by SWMU boundaries, and the current IWS likely creates more

co-mingling of plumes from multiple source areas toward IWS pumping wells located in the site interior. Residual DNAPL, as well as DNAPL diffused into finer-grained units, will likely continue to impact B aquifer groundwater.

Impacts to the C aquifer are far less in terms of the magnitude of groundwater concentrations and the margins of exceedances., especially in the eastern portion of the SWMU. However, there are breaks in the B/C aquitard, and there is the potential for downward migration from the B aquifer. In general, the D aquifer is less impacted than the C aquifer. Exceedances for the B aquifer under SWMU 8 were evaluated in the Treatability Study RIR (URS, 2010), which indicated that anaerobic degradation is occurring in the B aquifer beneath SWMU 8. Groundwater in the B, C, and D aquifers beneath SWMU 8 in its entirety are captured by the IWS. Groundwater in the E aquifer beneath SWMU 8 is contained by the E aquifer recovery well system. These systems prevent off-site groundwater migration. Additionally, groundwater containment and quality are monitored by several programs as reported in semi-annual DGW reports.

Institutional Controls:

- Site-wide security measures have been established as required by the DHS CFATS regulation.
- A site-wide deed notice will be established for the entire facility.
- The Chambers Works Complex has an approved groundwater CEA that covers the entire site.
- Plant security controls access on-site and to SWMU 8.
- Security monitors SWMU 8 on a daily basis.
- Site and area orientations are required for work in SWMU 8.
- Plant and CRG work permits are required for intrusive/subsurface work in SWMU 8. The plant permit process is a defined process in which locations where work will be performed are checked against site-wide maps. Relevant site environmental data, soil characterization, and utility information are also reviewed to confirm that appropriate PPE is being used for the work to be completed.

Engineering Controls:

- The entire site is contained within a perimeter security fence system including perimeter lighting, video surveillance, and motion detection. This perimeter security fence system, along with a continual professional security force presence, is designed to prevent unauthorized access to the site. There is also an interior fence around specific production areas within the manufacturing area, which is subject to the same security measures.
- Groundwater at Chambers Works is addressed on a site-wide basis. The IWS began operation in 1970 and currently includes seven recovery wells: G08-R01C, G08-R01D, K06-R02CD, M14-R02CD, Q13-R01C, Q13-R01D, and R09-R02C. These wells control groundwater from migrating off-site from the B, C, and D aquifers with a combined pumping rate of approximately 1,000,000 gallons/day. A semi-annual DGW report is generated and sent to the NJDEP that documents the

operation, maintenance, system status, and groundwater monitoring data related to the IWS in compliance with NJPDES Permits NJ0083429 and NJ0105872. DuPont will continue to operate the IWS to control site groundwater as required by NJPDES-DGW Permit No. NJ0083429 and HSWA Permit No. NJ002385730. Pumping from well J05-W01E began in August 1995 to contain E aquifer groundwater along the southern boundary of the site in response to minor detections of site constituents in that area. The J05-W01E pumping program was designed to augment the containment of E aquifer groundwater at Chambers Works, which was maintained by water supply well R15-W01E.

- Chambers Works has a site-wide NAPL survey program to 1) identify specific well locations where either LNAPL or DNAPL is present and 2) determine the feasibility of recovering DNAPL from specific wells. As of July 2014, there were 19 wells in the NAPL survey program, which includes 17 wells that are part of the monthly survey to recover DNAPL with a bailer and two wells with dedicated pumping systems. Currently, there are five locations within the SWMU 8 boundary that are included in the program.
- Groundwater monitoring is performed under several programs at Chambers Works. Monitoring wells within the SWMU 8 boundary include those to support the Perimeter Monitoring Program, Post-Closure RCRA SWMUs Monitoring Program (SWMU 21), and PFOA Monitoring Program. Groundwater monitoring data are reported semi-annually in the DGW reports.

Exposure Assessment Summary: SWMU 8, also known as former Landfill IV, is a 140-acre area which contains, in whole or in part numerous other SWMUs. SWMU 8 was the primary disposal site for solid and semi-solid wastes generated from the various operating areas of Chambers Works from approximately 1940 to 1975. Extensive investigations as part of the SWMU 8 RI (CRG, 2005) show that the landfill units are stable and do not contain intact drums. The nature of the fill material in SWMU 8 (including the physical and chemical properties of the fill) and the COPCs are consistent with past disposal practices. Shallow groundwater in the area of SWMU 8 also contains constituents above NJGWIIA.

Under current conditions, the surface cover is diverse (i.e., asphalt, concrete, gravel, foundations and vegetation) and provides a barrier to prevent worker exposure. In addition, institutional controls (i.e., plant security, work permits, site and area orientations, and the PPE requirement) are in place to further eliminate potential exposure to underlying soil. As indicated, groundwater is controlled by the IWS and is evaluated on a site-wide basis. Since groundwater is not used for any purposes in the SWMU 8 area, there is no exposure to groundwater.

A large portion of SWMU 8 does not contain any ecological habitat because of the hard surface cover material (i.e., asphalt, concrete, gravel) that is present. However, a majority of the area has a vegetative cover consisting of tall grasses, which provide low quality habitat for mobile animals. Forested areas are also present. As previously indicated, an 11.3-acre forested area is located within the traditional boundary of SWMU 8. However, there is no indication of manufacturing or waste management activities were conducted within this area. Two small impoundments are also located in the eastern portion of

SWMU 8 (Landfill IV Area) in an active area of the site. These two surface-water features (C and D Ponds) were evaluated, and no further evaluations were recommended for these areas.

Justification for a No Further Action: As indicated in the Exposure Assessment Summary, the existing surface cover in this area provides a protective barrier that eliminates potential exposure to impacted soil. Under current conditions, there is no potential concern for human health and the environment. Source zones below the groundwater table that may be impacting groundwater are being addressed by a CMS-RASR (URS, 2007) and follow-on treatability studies (URS, 2010 and Surbec, 2011). The B aquifer and the C and D aquifers beneath SWMU 8 are captured by the IWS. Groundwater in the E aquifer beneath SWMU 8 is contained by the E aquifer recovery well system. Additionally, groundwater containment and quality are monitored by several programs as reported in semi-annual DGW reports. Groundwater in the B aquifer and the C and D aquifers beneath SWMU 8 are recommended for a manufacturing area-wide CMS for groundwater.

Restrictions: No intrusive work will be conducted in SWMU 8 without the proper area orientations and permits.

Maintenance Requirements: None.

Biennial Inspection Requirements: Not applicable at this time.

References:

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SWMU 8 Photograph 1: SWMU 8 (Landfill IV) is a 140-acre area that was the primary disposal site for solid and semi-solid wastes generated at the site. This photograph depicts center of Landfill A.



SWMU 8 Photograph 2: This photograph depicts the Southwest Corner of Landfill A.



SWMU 8 Photograph 3: This photograph looks north from Landfill A.



SWMU 8 Photograph 4: This photograph is taken from the northwest corner of Landfill A, looking at the northwest corner of SWMU 8.



SWMU 8 Photograph 5: This photograph is looking southwest towards Landfill B.



SWMU 8 Photograph 6: This photograph depicts a forested area located at the southeast corner of SWMU 8.



SWMU 8 Photograph 7: This photograph shows a small pond, which is located in the southeast corner of SWMU 8.